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WENDEROTH, LIND & PONACK, L.L.P.
2033 K STREET N. W.
SUITE 800
WASHINGTON, DC 20006-1021

EXAMINER	
WHITTINGTON, KENNETH	

ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/573,593	TADA ET AL.	
	Examiner	Art Unit	
	KENNETH J. WHITTINGTON	2862	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10,13-15,18-23 and 25-29* is/are rejected.

7)☒ Claim(s) *11,12,16,17 and 24* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 March 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *3/24/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 7-9 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements. See MPEP § 2172.01. The omitted elements are: what is the other line from which the angle is formed. The claims current recite the film thickness is detected from an angle formed between a line connected between the point and the central point, but does not recite the other line. An angle requires a baseline and a second line, the angle formed there between. This claim is missing what is the baseline for this angle and thus is missing an essential element.

After reviewing the specification and drawings, amending this claim to provide a baseline for the angle as being either the reactive component axis of the rectangular coordinates or the resistive component axis of the rectangular coordinates would provide the claims with this missing essential element by providing both lines from which to measure the angle. Amending the claims in this manner would thus overcome this rejection.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 2, 5, 6 and 27-29 are rejected under 35 U.S.C. 102(b) as being anticipated by Li et al. (US6072313), hereinafter Li. Regarding claim 1, Li discloses an eddy current sensor comprising:

a sensor coil disposed near a conductive film formed on a substrate (See Li FIGS. 1-5, item 302);

a signal source configured to supply an AC signal to said sensor coil to produce an eddy current in the conductive film (See FIGS. 1-5 and disclosure related thereto, note sweep generator);

a detection circuit operable to detect the eddy current produced in the conductive film, said detection circuit being connected to said sensor coil (See FIGS. 1-5 and disclosure related thereto, note analyzer 130); and

a housing made of a material having a high magnetic permeability, said housing accommodating said sensor coil therein (See FIGS. 1-5, note item 306).

Regarding claim 2, Li discloses the housing has a cylindrical shape (See FIGS. 1-5, item 306).

Regarding claim 5, Li discloses the housing is disposed within a conductive member (See FIG. 4, note metal carrier 406).

Regarding claim 6, Li discloses an eddy current sensor comprising:

a sensor coil disposed near a conductive film formed on a substrate (See FIGS. 1-4, note item 302);

a signal source configured to supply an AC signal to said sensor coil to produce an eddy current in the conductive film (See FIGS. 1-5 and disclosure related thereto and note sweep generator);

a detection circuit operable to detect the eddy current produced in the conductive film, said detection circuit being connected to said sensor coil (See FIGS 1-5 and disclosure related thereto, item 130); and

an insulating member accommodating said sensor coil therein, said insulating member being embedded in a conductive material (See FIGS. 1-5, item 308).

Regarding claim 27, Li discloses a substrate processing apparatus comprising: a processing device configured to process the substrate (See Li FIGS. 7 and 8 and disclosure related thereto for processing the substrate); and the eddy current sensor as recited in claim 1 (See discussion above).

Regarding claim 28, Li discloses a polishing apparatus comprising: a polishing surface (See FIG. 4, item 400); a substrate holding device configured to hold the substrate and press the substrate against said polishing surface (See FIG. 4, items 406 and 402); and the eddy current sensor as recited in claim 1 (See discussion above).

Regarding claim 29, Li discloses a substrate deposition apparatus comprising: a substrate deposition device configured to deposit a conductive film on the substrate

(See FIG. 8 and disclosure related thereto); and the eddy current sensor as recited in claim 1 (See discussion above).

Claim 10 is rejected under 35 U.S.C. 102(b) as being anticipated by McClelland (US6369566). Regarding this claim McClelland discloses an eddy current sensor comprising:

a sensor coil disposed near a first conductive film formed on a substrate (See McClelland col. 3, lines 11-67, note eddy current sensor coil is placed near conductive film, Zircaloy on a fuel rod substrate);

a signal source configured to supply an AC signal to said sensor coil to produce an eddy current in the first conductive film (See col. 3, lines 11-67, note some source is supply coil with note frequencies);

a detection circuit operable to detect the eddy current produced in the first conductive film based on an impedance as viewed from said sensor coil (See col. 3, lines 61-67, note some circuit would monitor the impedance changes); and

a controller configured to specify first impedance coordinates of a resistance component and a reactance component of the impedance in rectangular coordinates and to perform phase rotation, parallel displacement, and expansion on the first impedance coordinates (See col. 4, lines 12-50, note reactance and resistance vector coordinates are phase rotated, offset corrected and expanded to remove crud layer measurements).

Claim 13 is rejected under 35 U.S.C. 102(e) as being anticipated by Le (US2005/0017712). Regarding claim 13, Le discloses an eddy current sensor comprising:

a sensor coil disposed near a conductive film formed on a substrate (See Le FIG. 1, note coil 14);

a signal source configured to supply an AC signal to said sensor coil to produce an eddy current in the conductive film (See FIG. 1, item 28);

a detection circuit operable to detect the eddy current produced in the conductive film based on an impedance as viewed from said sensor coil (See FIG. 1, note circuit shown);

a storage device operable to store a correction coefficient according to a deposition condition of the conductive film (See FIG. 1, item 36); and

a controller configured to specify a point including a resistance component and a reactance component of the impedance in rectangular coordinates and to correct the point by the correction coefficient stored in said storage device (See paragraphs 0073-0080).

Claims 15, 18-21, 23, 25 and 26 are rejected under 35 U.S.C. 102(b) as being anticipated by Lehman et al. (US2004/0189290), hereinafter Lehman.

Regarding claim 15, Lehman discloses an eddy current sensor comprising:

a sensor coil disposed near a conductive film formed on a substrate (See Lehman FIG. 2, item 202b);

a signal source configured to supply an AC signal to said sensor coil to produce an eddy current in the conductive film (See FIG. 2, item 208);

a detection circuit operable to detect the eddy current produced in the conductive film based on an impedance as viewed from said sensor coil (See FIG. 2, item 250); and

a controller configured to specify an impedance coordinates of a resistance component and a reactance component of the impedance in rectangular coordinates and to move the impedance coordinates on a semicircular locus in the rectangular coordinates according to progress of a process (See FIG. 4 and disclosure related thereto, not lift-off curve V for each sample is formed comprising a semicircular curve, each curve representing conductance without influence of distance between sample and coil).

Regarding claim 18, Lehman discloses the impedance dramatically varies along one of axes in the rectangular coordinates, wherein said controller is configured to select the one of axes in the rectangular coordinates (See FIG. 4, note curve V).

Regarding claim 19, Lehman discloses the impedance coordinates are configured to be set by an offset, an amplification degree, phase rotation, or polarity selection of a main amplifier (See FIG. 2, note items 206, 210, 214, 216, 218, 220. Note impedance is always configured to be set by one or more of these parameters).

Regarding claim 20, Lehman discloses controller is configured to measure the impedance coordinates every predetermined time and to detect an endpoint of a

process based on a correlation between an impedance characteristic and model data (See FIGS. 3A-3D and paragraphs 0054-0066).

Regarding claim 21, Lehman discloses the controller is configured to predict a remaining time until an endpoint of a process (See FIGS. 3A-3D and paragraphs 0054-0066).

Regarding claim 23, Lehman discloses an eddy current sensor comprising:

a sensor coil disposed near a substrate having a plurality of zones (See FIG. 2, note sensor coil 202b and wafer 205, which has multiple zones, i.e., inner radial and outer radial or sectional);

a signal source configured to supply an AC signal to said sensor coil to produce an eddy current in the substrate (See FIG. 2, note item 208);

a detection circuit operable to obtain signal data on the eddy current produced in the plurality of zones of the substrate (See FIG. 2, note circuit 250); and

a controller configured to detect an endpoint of a process based on the signal data (See FIGS. 3A-3D and paragraphs 0054-0066).

Regarding claim 25, Lehman discloses the controller is configured to perform an edge cutting process on the signal data, wherein the signal data includes X and Y components of an impedance, a phase .theta., a synthesis impedance Z, a frequency F, and a film thickness value converted therefrom (See FIGS. 3A-3D and paragraphs 0054-0066, note edge cutting as understood in the specification is simply part of the endpoint determination process).

Regarding claim 26, Lehman discloses the controller is configured to perform an arithmetical operation on a reference time, which is calculated from the signal data, with a coefficient to calculate an additional period of process time and add the additional period of process time to the reference time so as to detect the endpoint of the process (See FIGS. 3A-3D and paragraphs 0054-0066).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tada et al. (JP2003-106805), hereinafter Tada, in view of Li. Regarding claim 1, Tada teaches an eddy current sensor comprising:

a sensor coil disposed near a conductive film formed on a substrate (See Tada FIGS. 1-8, item 10);

a signal source configured to supply an AC signal to said sensor coil to produce an eddy current in the conductive film (See FIGS. 1-8, item 3);

a detection circuit operable to detect the eddy current produced in the conductive film, said detection circuit being connected to said sensor coil (See FIG. 4, note circuit shown), and

the sensor coil disposed in a platen within the polishing apparatus (See FIG. 8, note item 10 in item 21).

However, Tada does not explicitly teach a housing for the sensor. Li teaches a housing made of a material having a high magnetic permeability, said housing accommodating said sensor coil therein (See FIGS. 1-5, note item 306). It would have been obvious at the time the invention was made to incorporate the magnetic housing of Li into the apparatus of Tada. One having ordinary skill in the art would do so to enhance the directional sensitivity of the eddy current sensor and prevent flux leakage (See Li col. 7, line 62 to col. 8, line 29).

Regarding claim 3, this combination teaches the sensor coil comprises: an excitation coil operable to produce an eddy current in the conductive film; and a detection coil operable to detect the eddy current produced in the conductive film (See Tada FIGS. 1 and 6, note inner excitation coil 12 and outer detection coil 13).

Regarding claim 4, this combination teaches the sensor coil further comprises a balance coil operable to adjust a zero point of a detection output in cooperation with said detection coil (See Tada FIGS. 1 and 6, not item 14).

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over McClelland in view of Le. Regarding this claim, McClelland teaches the features of claim 10 as noted above, but not a calibration method. Le teaches a controller is configured so that the resistance component and the reactance component are constant when film thickness of a reference conductive film is measured (See Le paragraphs

0042-0072, note several calibration samples are used to create calibration curves). It would have been obvious to incorporate the calibration method into the apparatus of McClelland. One having ordinary skill in the art would do so to create a reference data for reference films in the controller (See Le paragraphs 0042-0072).

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lehman in view of Li. Regarding this claim, Lehman teaches the features of claim 15 as discussed above, but not a conductive layer. Li teaches the substrate held by a substrate holding device having a conductive member located away from said sensor coil (See Li FIGS. 4-5, note metal table 410 holding wafer 100 with ferrite layer there between). It would have been obvious at the time the invention was made to use a metal table as the substrate holding device in the apparatus of Lehman. One having ordinary skill in the art would do so because Lehman does not teach the particular material for the substrate holding device and Li teaches it is common to use a metal carrier for the film. It is also noted that Li further teaches placing a ferrite layer between the conductive film and the holding device so the conductive member has no influence on the eddy current sensor (See Li col. 9, lines 8-17).

Allowable Subject Matter

Claims 7-9 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action. The following is a statement of reasons for the indication of allowable subject matter in

claims 7-9: the prior art does not teach measuring the film thickness based on an angle between the recited line and a baseline in combination with the other features of the claims.

Claims 11, 12, 16, 17 and 24 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter in claims 11 and 12: the prior art does not show or teach performing phase rotation of second impedance coordinates of a second conductive material to obtain a change in the first impedance coordinates when the first are influenced by the second as recited in the claims and in combination with the other features of the claims.

The following is a statement of reasons for the indication of allowable subject matter in claims 16 and 17: the prior art does not show or teach calculating a change in thickness based on an arc length on the semicircular locus on which the impedance coordinates move as recited in the claims and in combination with the other features of the claims.

The following is a statement of reasons for the indication of allowable subject matter in claim 24: the prior art does not show or teach comparing the determination value with the predetermined value to detect an endpoint, the determination value including the values noted, as recited in the claim and in combination with the other features of the claim.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KENNETH J. WHITTINGTON whose telephone number is (571)272-2264. The examiner can normally be reached on Monday-Friday, 7:30am-4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Assouad can be reached on (571) 272-2210. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Kenneth J Whittington/
Primary Examiner, Art Unit 2862